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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	004164.P004
First Inventor or Application Identifier	Stephen John Ruiz
Title	AERODYNAMIC STANDOFFS TO AIR COOL DISC TYPE AUTO BRAKE
Express Mail Label No.	EM560345696US

APPLICATION ELEMENTS
See MPEP chapter 600 concerning utility patent application contents

ADDRESS TO: Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231

1. [X] Fee Transmittal Form *(e.g. PTO/SB/17)* *(Submit an original, and a duplicate for fee processing)*
2. [X] Applicant claims small entity status. See 37 CFR 1.27.
3. [X] Specification — Total Pages: 19
   (preferred arrangement set forth below)
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to sequence listing, a table, or a computer program listing appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings (if filed)
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
4. [X] Drawing(s) *(35 U.S.C.113)* — Total Sheets: 9
5. Oath or Declaration — Total Pages:
   a. [ ] Newly executed (original copy)
   b. [ ] Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional with Box 16 completed)*
      i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. [ ] Application Data Sheet. See 37 CFR 1.76.
7. [ ] CD-ROM or CD-R in duplicate, large table or Computer Program *(Appendix)*
8. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
   a. [ ] Computer Readable Form (CFR)
   b. [ ] Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

9. [X] Assignment Papers (cover sheet & document(s))
10. [ ] 37 CFR 3.73(b) Statement *(when there is an assignee)* [X] Power of Attorney
11. [ ] English Translation Document *(if applicable)*
12. [ ] Information Disclosure Statement (IDS)/PTO - 1449 [ ] Copies of IDS Citations
13. [ ] Preliminary Amendment
14. [ ] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
15. [ ] Certified Copy of Priority Document(s) *(if foreign priority is claimed)*
16. [X] Other: Return Postcard

17. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in a preliminary amendment:*
[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No: ____/________
Prior application Information: Examiner ____________ *Group/Art Unit:* ________
For CONTINUATION or DIVISIONAL APPS only: The entire disclosure of the prior application, from which an oath or declaration is supplied under Box 4b, is considered a part of the disclosure of the accompanying continuation or divisional application and is hereby incorporated by reference. The incorporation can only be relied upon when a portion has been inadvertently omitted from the submitted application parts.

17. CORRESPONDENCE ADDRESS

[ ] *Customer Number of Bar Code Label* *(Insert Customer No. or Attach bare code label here)* or [X] *Correspondence address below*

Name	BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP				
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Name (Print/Type)	Eric S. Hyman, Reg. No. 30,139		
Signature		Date	11/15/00

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FEE TRANSMITTAL for FY 2001

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT ($) 615.00

Complete if Known	
Application Number	
Filing Date	11/15/00
First Named Inventor	Stephen John Ruiz
Examiner Name	
Group Art Unit	
Attorney Docket Number	004164.P004

METHOD OF PAYMENT (check one)

1. ☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number: 02-2666

Deposit Account Name: Blakely, Sokoloff, Taylor & Zafman LLP

☒ Charge Any Additional Fee Required Under 37CFR 1.16 and 1.17

☐ Applicant claims small entity status. See 37 CFR 1.27

2. ☒ Payment Enclosed:

☒ Check ☐ Money Order ☐ Other

FEE CALCULATION

1. FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	710	201	355	Utility filing fee	$355
106	320	206	160	Design filing fee	
107	490	207	245	Plant filing fee	
108	710	208	355	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 355.00

2. EXTRA CLAIM FEES

			Extra Claims		Fee from below		Fee Paid
Total Claims	40	-20** =	20	X	$9.00	=	180.00
Independent Claims	4	-3** =	1	X	$40.00	=	40.00
Multiple Dependent						=	

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	80	202	40	Independent claims in excess of 3
104	270	204	135	Multiple Dependent claim
109	80	209	40	**Reissue independent claims over original patent
110	18	210	9	**Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 220.00

**or number of previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet.	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for response within first month	
116	390	216	195	Extension for response within second month	
117	890	217	445	Extension for response within third month	
118	1,390	218	695	Extension for response within fourth month	
128	1,890	228	945	Extension for response within fifth month	
119	310	219	155	Notice of Appeal	
120	310	220	155	Filing a brief in support of an appeal	
121	270	221	135	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidably	
141	1,240	241	620	Petition to revive - unintentionally	
142	1,240	242	620	Utility issue fee (or reissue)	
143	440	243	220	Design issue fee	
144	600	244	300	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	710	246	355	Filing a submission after final rejection (37 CFR 1.129(a))	
149	710	249	355	For each additional invention to be examined (37 CFR 1.129(b))	
179	710	279	355	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) Recordation of Assignment fee — 40.00

* Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 40.00

SUBMITTED BY				Complete (if applicable)	
Typed or Printed Name	Eric S. Hyman, Reg. No. 30,139			Reg. Number	
Signature	[signature]	Date	11/15/00	Deposit Account User ID	02-2666

Attorney Docket No.: 004164.P004

☐ Applicant ______________________ ☐ Patentee ______________________
☐ Application No. ______________________ ☐ Patent No. ______________________
☒ Filed on ______________________ ☐ Issued on ______________________

Title: AERODYNAMIC STANDOFFS TO AIR COOL DISC TYPE AUTO BRAKE ROTORS

VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) AND 1.27(b)) - INDEPENDENT INVENTOR

As a below named inventor, I hereby declare that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, to the Patent and Trademark Office, with regard to the invention described in

☒ the specification filed herewith, with title as listed above.
☐ the application identified above.
☐ the patent identified above.

I have not assigned, granted, conveyed or licensed and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person who could not be classified as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey or license any rights in the invention is listed below:

☐ No such person, concern, or organization exists.
☒ Each such person, concern or organization is listed below.*

**NOTE: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)*

FULL NAME Stop Technologies, LLC
ADDRESS 3015 Kashiwa Street
Torrance, CA 90505

☐ INDIVIDUAL ☒ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

FULL NAME ______________________
ADDRESS ______________________

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

FULL NAME ______________________
ADDRESS ______________________

☐ INDIVIDUAL ☐ SMALL BUSINESS CONCERN ☐ NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

Stephen John Ruiz		
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
Signature of Inventor	Signature of Inventor	Signature of Inventor
11-15-02		
DATE	DATE	DATE

Docket No. 004164.P004

Express Mail No. EM560345696US

UNITED STATES PATENT APPLICATION

FOR

AERODYNAMIC STANDOFFS TO AIR COOL DISC TYPE AUTO BRAKE ROTORS

Inventor:

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Prepared by:

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AERODYNAMIC STANDOFFS TO AIR COOL DISC TYPE AUTO BRAKE ROTORS

BACKGROUND OF THE INVENTION

Field of the Invention

The invention includes an apparatus for improving air flow away from a disk brake rotor system used in a vehicle. More particularly, the invention relates to improved air flow motion over a disk brake rotor system used in a vehicle through aerodynamic standoffs.

Background Information

Friction brakes are used in cars, trains, airplanes, elevators, motorcycles and other machines. In order to slow or stop an automobile, a driver may step on a brake pedal. Through mechanical linkage, the movement of the brake pedal is transmitted to a set of opposing fixed brake pads, between which is a brake rotor that rotates as the axle of the automobile turns from the rotation of the wheel assembly due to energy stored in the vehicle as either kenetic or potential. The brake rotor may be fixed to the hub of a vehicle axle by an array of drive pin or drive lug/bolt combinations radially distributed about the axle. The brake rotor and the hub may be secured to one another by tightening each bolt and washer into its counter part drive pin or drive lug.

As the driver applies force to the brake pedal, that force may be transmitted as friction to the moving brake rotor by the fixed brake pads so as to slow the vehicle down or bring it to rest through controlled slippage. The energy absorbed by the controlled slippage may be converted into heat, principally within the brake rotor. In high performance vehicle applications, vents may be supplied between the inboard brake disc and the outboard brake disc to channel air over the surfaces of the discs so as to draw heat away from the discs. See, e.g., U.S. 5,878,848, entitled "Ventilated Brake Rotor." Moreover, as illustrated in U.S. 5,915,747, entitled "Method of Making a Rotor with Vented Hat Section and an Initial Casting," vents may be added to the sidewall of the brake rotor hub (or "mounting hat") to aid in cooling.

In addition to vents, brake rotor hub radial standoffs may be provided (i) to form a

brake rotor/hub mating surface and (ii) to elevate the brake rotor hub from the brake rotor.

SUMMARY

The invention includes a mounting hat for a brake rotor having a lower section connected to an upper section. Also included is a plurality of aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top and a bottom connected to the upper section. Further, a plurality of vents are formed between adjacent aerodynamically shaped standoff vanes. The vents are circumferentially distributed on the upper section. Air flow is induced to flow through the plurality of vents.

Alternatively included is a mounting hat for a brake rotor having a lower section connected to an upper section. Also included is a plurality of first aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top and a bottom connected to the upper section. Further, a plurality of second aerodynamically shaped standoff vanes each having a leading edge, a trailing edge and a top connected to the upper section is included. Additionally, a plurality of vents are formed between adjacent first aerodynamically shaped standoff vanes and second aerodynamically shaped standoff vanes. The vents are circumferentially distributed on the upper section. Air flow is induced to flow through the plurality of vents.

Further, a brake rotor having a rotor and a hub having a plurality of aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top, a bottom and a plurality of vents formed between adjacent aerodynamically shaped standoff vanes connected to the rotor is presented. The vents are circumferentially distributed between the hub and the rotor. Air flow is induced to flow through the plurality of vents.

Lastly, A brake rotor having a rotor and a hub having a plurality of first aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top and a bottom connected to the hub is presented. A plurality of second aerodynamically shaped standoff vanes each having a leading edge, a trailing edge and a top connected to

the hub is also presented. Also, a plurality of vents formed between adjacent first aerodynamically shaped standoff vanes and second aerodynamically shaped standoff vanes is included. The vents are circumferentially distributed between the hub and the rotor. Air flow is induced to flow through the plurality of vents.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a brake rotor with hub or mounting hat.

Figure 2 illustrates a typical hub or mounting hat with rectangular shaped standoff vanes.

Figure 3 illustrates an embodiment of the invention having aerodynamically shaped standoff vanes.

Figure 4 illustrates a side view of an embodiment of the invention having aerodynamically shaped standoff vanes.

Figure 5 illustrates air flow through vents formed by an embodiment of the invention having aerodynamically shaped standoff vanes.

Figure 6 illustrates the induced path of delaminated air from rotor vents in an embodiment of the invention having aerodynamically shaped standoff vanes.

Figure 7 illustrates an embodiment of the invention having aerodynamically shaped standoff vanes with additional aerodynamically shaped standoff vanes.

Figure 8 illustrates a side view of an embodiment of the invention having aerodynamically shaped standoff vanes with additional aerodynamically shaped standoff vanes.

Figure 9 illustrates an embodiment of the invention where the hub or mounting hat is formed so as to accept separate aerodynamically shaped standoff vanes.

Figure 10 illustrates separate aerodynamically shaped standoff vane.

Figure 11 illustrates separate aerodynamically shaped standoff vanes coupled to a hub or mounting hat having openings on an upper section.

Figure 12 illustrates a traditional hub or mounting hat with squared standoffs and openings.

Figure 13 illustrates an embodiment of the invention with aerodynamically shaped standoff vanes coupled to a hub or mounting hat having openings on an upper section.

Figure 14 illustrates the embodiment of Figure 13 coupled with a rotor.

DETAILED DESCRIPTION OF THE INVENTION

Figure 1 is an exploded isometric view of brake rotor assembly 100. Included with brake rotor assembly 100 may be rotor 110, hub or mounting hat 120, drive pins/lugs 130, bolts 140, and washers 150. In some lower performance applications, rotor 110 and hub 120 may be one piece. As shown, rotor 110 may be an annular ring having slots 112 disposed on the interior of the ring. Slots 112 may be used to connect rotor 110 to hub 120 and yet allow for thermal expansion of rotor 110.

Hub 120 may be an annular disc that includes axle hole 122 and pin/lug holes 124. Axle hole 122 may be where an axle of a vehicle might extend into so as to maintain rotor 110 adjacent to the brake pads and tire of the vehicle. Drive pins/lugs 130 may have a threaded interior and are extended through pin/lug holes 124 and slots 112 so as to bring hub 120 in contact with rotor 110. Drive pins/lugs 130 may be squared to remove excessive material for weight savings. Washers 150 are inserted around bolts 140 and bolts 140 are threaded into drive pin/lug 130. Tightening bolts 140 into drive pins/lugs 130 fixes hub 120 to rotor 110 in the rotational and axial directions, but frees rotor 110 to expand in the radial direction.

Brake rotor 110 may include vanes 106 disposed between inboard brake disc 114 and outboard brake disc 116. Vanes 106 may form vents 128 to channel air over the facing surfaces of inboard brake disc 114 and outboard brake disc 116 to draw heat away from the discs.

In addition to vents 128, hub 120 may include standard standoffs 126. Standoffs 126 may be elevated and have a top surface to form a brake rotor/hub mating surface. On mating, the elevation of brake rotor hub 120 from brake rotor 110 forms gaps 132 that may further channel portions of air over a surface of outboard disc 116 as brake rotor

assembly 100 rotates.

Figure 2 is an isometric view of traditional hub or mounting hat 120 from the brake rotor side. Standoffs 126 may be evenly distributed radially about axle hole 122. The perimeter of each standoff conventionally is shaped for manufacturing purposes (such as for machining or molding) rather than for operational purposes. As illustrated, standoffs 126 conventionally define straight edge profile such as a square or rectangular shape. As hub 120 rotates about axle hole 122, the straight edge profile of standoffs 126 push air out of its way with little thought as to a preferred direction of the air. In other words, the square or rectangular shape of the standoff is not aerodynamically shaped. Delaminating turbulent waves are formed behind and in front of the square or rectangular shaped standoffs 126 as air is deflected off the rotor. The delaminated air does not contribute to transferring heat away from rotor 110 through convection and, therefore does not contribute towards efficiently cooling it down.

Figure 3 illustrates an embodiment of the invention with hub or mounting hat 300 having aerodynamically shaped standoff vanes 302. Hub 300 also includes upper section 310 and lower section 320. **Figure 4** illustrates a side view of the embodiment of the invention illustrated in **Figure 3**. In **Figure 3**, Two adjacent standoff vanes 302 may define vents 304. Vents 304 may be distributed circumferentially on upper section 310 on hub 300. As hub 300 turns about the axle of a vehicle, standoff vanes 302 work to induce air flow from the radial interior of hub 300, through vents 304, and out to the radial exterior of hub 300. In other words, air flow is induced by the shape of standoff vanes 302 and the centrifugal acceleration of the air in vents 304 when hub 300 is turning and turbulent air is thus reduced. It should be noted that hub 300 and brake rotor 110 may also be formed as a solid brake rotor.

Figure 5 illustrates the direction of air flow 510 through vents 304. The air passing within vents 304 passes over outboard brake disc 116 of **Figure 1** and expels the heat radially outward in the direction of the moving hub 300. This process works towards transferring heat away from rotor 110 through convection and cools the rotor down in an efficient manner. **Figure 6** illustrates air flow through vents 128 directed by

vanes 106 and the air flow induced to flow through vents 304. Air flow 620 that is deflected by vanes 106 and rotor 600 is induced into vents 304 and flows in flow direction 510. Therefore, additional air flow is directed towards outboard brake disc 116 of **Figure 1** and heat is expelled radially outward in the direction of the moving hub 300 providing more efficient cooling.

Aerodynamically shaped standoff vanes 302 can vary in length, height, width and shape to optimally increase the air flow to be induced through vents 304. In one embodiment, the leading edge of the aerodynamically shaped standoff vanes 302 is curved, as is the trailing edge. Both the leading edge and trailing edge of aerodynamically shaped standoff vanes 302 need not be symmetrical. In one embodiment, the leading and trailing edges of aerodynamically shaped standoff vanes 302 are stepped up at 90 degrees from the upper section 310 to the height of the aerodynamically shaped standoff vane 302 (i.e., perpendicular to upper section 310). In another embodiment, the leading and trailing edge of aerodynamically shaped standoff vanes 302 can be ramped or curved up at varying angles and dimensions from the upper section 310 to the height of the aerodynamically shaped standoff vane 302 to increase induced air flow.

In one embodiment, aerodynamically shaped standoff vanes 302 are placed so that the rotor is unidirectional. In another embodiment, a symmetrical design allows for a bi-directional rotor, which reduces inventory and eases exchange between vehicle wheels. The shapes and sizes of the aerodynamically shaped standoff vanes 302 can have height adjusted depending on the application and the type of vehicle. There is a tradeoff of weight versus height of the aerodynamically shaped standoff vanes 302. For example, in high performance racing cars, where weight is important and stress factors are increased over standard type of vehicles, the height of the aerodynamically shaped standoff vanes 302 may typically be about 5mm. A standard height of the aerodynamically shaped standoff vanes 302 may range between 2mm-4mm. The width of aerodynamically shaped standoff vanes 302 are typically based on the complimentary dry flange so that the counter part and the width of the aerodynamically shaped standoff vanes 302 are close to being matched. One skilled in the art will note that the width can vary from the

complementary dry flange counterpart.

The number of aerodynamically shaped standoff vanes 302 is predetermined by drive pins/lugs 130 and number of lugs on the vehicle, which are determined by the amount of load and design of the drive mechanism.

Figure 7 illustrates an embodiment of the invention with hub or mounting hat 700 having aerodynamically shaped standoff vanes 302 and additional aerodynamically shaped standoff vanes 702. Hub 700 also includes upper section 710 and lower section 720. **Figure 8** illustrates a side view of the embodiment illustrated in **Figure 7**. In **Figure 7**, besides the two aerodynamically shaped standoff vanes 302 and 702, additional aerodynamically shaped standoff vanes can be added to hub 700 to increase air flow through vents defined between adjacent standoff vanes. Adjacent standoff vanes 302 and 702 may define vents 730 and 740. Vents 730 and 740 may be distributed circumferentially on upper section 710. As hub 700 turns about the axle of a vehicle, standoff vanes 302 and 702 work to induce air flow from the radial interior of hub 700, through vents 730 and 740, and out to the radial exterior of hub 700. In other words, air flow is induced by the shape of standoff vanes 302 and 702 and the centrifugal acceleration of the air in vents 730 and 740 when hub 700 is turning and turbulent air is reduced. The air passing within vents 730 and 740 passes over outboard brake disc 116 of **Figure 1** and expels heat radially outward in the direction of the moving hub 700. One skilled in the art will recognize as additional aerodynamically shaped standoff vanes are added to hub 700, additional smaller vents are formed on upper section 710. It should be noted that hub 700 and brake rotor 110 may also be formed as a solid brake rotor.

Aerodynamically shaped standoff vanes 702 can vary in length, height, width and shape to optimally increase the air flow to be induced through vents 730 and 740. In one embodiment, the leading edge of the aerodynamically shaped standoff vanes 702 is curved, as is the trailing edge. Both the leading edge and trailing edge of aerodynamically shaped standoff vanes 702 need not be symmetrical. In one embodiment, the leading and trailing edge of aerodynamically shaped standoff vanes 702 is stepped up at 90 degrees from upper section 710 to the height of aerodynamically shaped standoff vanes 702 (i.e.,

perpendicular to upper section 710). In another embodiment, the leading and trailing edge of aerodynamically shaped standoff vanes 702 can be ramped or curved up at varying angles and dimensions, from upper section 710 to the height of the aerodynamically shaped standoff vanes 702 to increase induced air flow.

In one embodiment, aerodynamically shaped standoff vanes 702 are placed so that the rotor is unidirectional. In another embodiment, a symmetrical design can allow for a bi-directional rotor, which reduces inventory and eases exchange between vehicle wheels. The shapes and sizes of aerodynamically shaped standoff vanes 702 can have height adjusted depending on the application and the type of vehicle. There is a tradeoff of weight versus height of the aerodynamically shaped standoff vanes 702. For example, in high performance racing cars, where weight is important and stress factors are increased over standard type of vehicles, the height of the aerodynamically shaped standoff vanes 702 may typically be about 5mm. A standard height of the aerodynamically shaped standoff vanes 702 may typically range between 2mm-4mm. One skilled in the art will note that in hub 700, the height of aerodynamically shaped standoff vanes 302 and 702 can vary from each other to increase air flow through vents formed between aerodynamically shaped standoff vanes. The width of aerodynamically shaped standoff vanes 702 may vary, thus varying the size of vents.

In hub 700, the number of aerodynamically shaped standoff vanes 302 is predetermined by drive pins/lugs 130 and number of lugs on the vehicle, which are determined by the amount of load and design of the drive mechanism. Aerodynamically shaped standoff vanes 702, however, are not predetermined by drive pins/lugs 130 and the number of lugs on the vehicle.

Figure 9 illustrates an embodiment of the invention with hub or mounting hat 900 having a lower section 910 and an upper section 920. Upper portion 920 can accept separate aerodynamically shaped standoff vanes 940 into openings 930 on upper section 920. One skilled in the art will recognize that additional openings can be formed on upper section 920 for additional aerodynamically shaped standoff vanes that are separate from hub 900. Also, one skilled in the art will recognize that upper section 920 can also have

additional aerodynamically shaped standoff vanes formed on upper section 920 between adjacent aerodynamically shaped standoff vanes 940. **Figure 10** illustrates separate aerodynamically shaped standoff vanes 940 with extension section 1010 that can be coupled with hub or mounting hat 900 via openings 930. Openings 930 may vary in shape and size depending on the application and the shape and size of extension section 1010 which, can also vary in shape and size depending on the application.

Figure 11 illustrates hub or mounting hat 1100 having separate aerodynamically shaped standoff vanes 940 fitted into openings 930 on upper section 920. Extension section 1010 of aerodynamically shaped standoff vanes 940 is made so that it fits snug into openings 930. Adjacent aerodynamically shaped standoff vanes 940 may define vents 950.

In **Figure 11**, it can be readily seen that additional aerodynamically shaped standoff vanes can be added to hub 1100 to increase air flow through vents defined between adjacent standoff vanes 940. Vents formed by adjacent aerodynamically shaped standoff vanes 940 may be distributed circumferentially on upper section 920. As hub 1100 turns about the axle of a vehicle, standoff vanes work to induce air flow from the radial interior of hub 1100, through vents, and out to the radial exterior of hub 1100. In other words, air flow is induced by the shape of standoff vanes and the centrifugal acceleration of the air in vents when hub 1100 is turning and turbulent air is reduced. The air passing within vents passes over outboard brake disc 116 of **Figure 1** and expels heat radially outward in the direction of the moving hub 1100. One skilled in the art will recognize as additional aerodynamically shaped standoff vanes are added to hub 1100, additional smaller vents are formed on upper section 920.

Aerodynamically shaped standoff vanes 940 can vary in length, height, width and shape to optimally increase the air flow to be induced through vents. In one embodiment, the leading edge of the aerodynamically shaped standoff vanes 940 is curved, as is the trailing edge. Both the leading edge and trailing edge of aerodynamically shaped standoff vanes 940 need not be symmetrical. In one embodiment, the leading and trailing edge of aerodynamically shaped standoff vanes 940 is stepped up at 90 degrees from upper

section 920 to the height of aerodynamically shaped standoff vanes 940 (i.e., perpendicular to upper section 920). In another embodiment, the leading and trailing edge of aerodynamically shaped standoff vanes 940 can be ramped or curved up at varying angles and dimensions, from upper section 920 to the height of the aerodynamically shaped standoff vanes 940 to increase induced air flow.

In one embodiment, aerodynamically shaped standoff vanes 940 are placed so that the rotor is unidirectional. Separate aerodynamically shaped standoff vanes 940 with extension section 1010 can be coupled to a hub or mounting hat that typically does not contain standoff vanes. Thus, transforming ordinary non-aerodynamic hubs into hubs containing separate aerodynamically shaped standoff vanes 940 with extension section 1010 to optimally increase the air flow to be induced through formed vents. Moreover, separate sets of aerodynamically shaped standoff vanes 940 with extension section 1010, where each set may be oppositely contoured, can reduce inventory of hubs or mounting hats since they may be coupled to the same bi-directional hub. Thus transforming the bi-directional hubs to unidirectional hubs. This feature reduces inventory and eases exchange between vehicle wheels.

The shapes and sizes of aerodynamically shaped standoff vanes 940 can have height adjusted depending on the application and the type of vehicle. There is a tradeoff of weight versus height of the aerodynamically shaped standoff vanes 940. For example, in high performance racing cars, where weight is important and stress factors are increased over standard type of vehicles, the height of the aerodynamically shaped standoff vanes 940 may typically be about 5mm from upper section 920 to the top of aerodynamically shaped standoff vanes 940. A standard height of the aerodynamically shaped standoff vanes 940 may typically range between 2mm-4mm. One skilled in the art will note that in hub 1100, the height of aerodynamically shaped standoff vanes 940 can vary from each other to increase air flow through vents formed between aerodynamically shaped standoff vanes. The width of aerodynamically shaped standoff vanes 940 may vary, thus varying the size of vents.

In hub 1100, the number of aerodynamically shaped standoff vanes 940 is

predetermined openings 930, by drive pins/lugs 130 that fit in space 960 and number of lugs on the vehicle, which are determined by the amount of load and design of the drive mechanism. Additionally added aerodynamically shaped standoff vanes added between aerodynamically shaped standoff vanes 940, however, are not predetermined by drive pins/lugs 130 and the number of lugs on the vehicle.

Figure 12 is an isometric view of traditional hub or mounting hat 1200 from the brake rotor side. Traditional hub 1200 typically has openings 1220, upper section 1250, lower section 1240, and a gap 1230 between adjacent standoffs 1210. Standoffs 1210 may be evenly distributed radially about upper section 1250 on hub 1200. The perimeter of each standoff conventionally is shaped for manufacturing purposes (such as for machining or molding) rather than for operational purposes. As illustrated, standoffs 1210 conventionally define straight edge profile such as a square or rectangular shape. As hub 1200 rotates about the axle hole, the straight edge profile of standoffs 1210 push air out of its way with little thought as to a preferred direction of the air. In other words, the square or rectangular shape of the standoff is not aerodynamically shaped. Delaminating turbulent waves are formed behind and in front of the square or rectangular shaped standoffs 1210 as air is deflected off the rotor. The delaminated air does not contribute to transferring heat away from rotor 110 through convection and, therefore does not contribute towards efficiently cooling it down.

Figure 13 illustrates an embodiment of the invention with hub or mounting hat 1300 having aerodynamically shaped standoff vanes 1310. Hub 1300 also includes upper section 1330, lower section 1320, and opening 1350. In **Figure 3**, Two adjacent standoff vanes 1310 may define vents 1340. Vents 1340 may be distributed circumferentially on upper section 1330 on hub 1300. As hub 1300 turns about the axle of a vehicle, standoff vanes 1310 work to induce air flow from the radial interior of hub 1300, through vents 1340, and out to the radial exterior of hub 1300. In other words, air flow is induced by the shape of standoff vanes 1310 and the centrifugal acceleration of the air in vents 1340 when hub 1300 is turning and turbulent air is thus reduced. It should be noted that hub 1300 and brake rotor 110 may also be formed as a solid brake rotor.

Figure 14 illustrates brake rotor system 1400 having hub 1300 coupled to rotor 1410. The air passing within vents 1340 passes over outboard brake disc 116 of **Figure 1** and expels the heat radially outward in the direction of the moving hub 1300. This process works towards transferring heat away from rotor 1410 through convection and cools the rotor down in an efficient manner. Air flow that is deflected by vanes 106 and rotor 1410 is induced into vents 1340. Therefore, additional air flow is directed towards outboard brake disc 116 of **Figure 1** and heat is expelled radially outward in the direction of the moving hub 1300 providing more efficient cooling.

Aerodynamically shaped standoff vanes 1340 can vary in length, height, width and shape to optimally increase the air flow to be induced through vents 1340. In one embodiment, the leading edge of the aerodynamically shaped standoff vanes 1340 is curved, as is the trailing edge. Both the leading edge and trailing edge of aerodynamically shaped standoff vanes 1340 need not be symmetrical. In one embodiment, the leading and trailing edges of aerodynamically shaped standoff vanes 1340 are stepped up at 90 degrees from the upper section 1330 to the height of the aerodynamically shaped standoff vane 1340 (i.e., perpendicular to upper section 1330). In another embodiment, the leading and trailing edge of aerodynamically shaped standoff vanes 1340 can be ramped or curved up at varying angles and dimensions from the upper section 1330 to the height of the aerodynamically shaped standoff vane 1340 to increase induced air flow.

In one embodiment, aerodynamically shaped standoff vanes 1340 are placed so that the rotor is unidirectional. In another embodiment, a symmetrical design allows for a bi-directional rotor, which reduces inventory and eases exchange between vehicle wheels. The shapes and sizes of the aerodynamically shaped standoff vanes 1340 can have height adjusted depending on the application and the type of vehicle. There is a tradeoff of weight versus height of the aerodynamically shaped standoff vanes 1340. For example, in high performance racing cars, where weight is important and stress factors are increased over standard type of vehicles, the height of the aerodynamically shaped standoff vanes 1340 may typically be about 5mm. A standard height of the aerodynamically shaped standoff vanes 1340 may range between 2mm-4mm. The width of aerodynamically

shaped standoff vanes 1340 are typically based on the complimentary dry flange so that the counter part and the width of the aerodynamically shaped standoff vanes 1340 are close to being matched. One skilled in the art will note that the width can vary from the complementary dry flange counterpart.

The number of aerodynamically shaped standoff vanes 1340 is predetermined by drive pins/lugs or connectors to be inserted through openings 1350 and number of lugs on the vehicle, which are determined by the amount of load and design of the drive mechanism.

The exemplary embodiments described herein are provided merely to illustrate the principles of the invention and should not be construed as limiting the scope of the subject matter of the terms of the claimed invention. The specification and drawings are, accordingly, to be regarded in an illustrative rather than a restrictive sense. Moreover, the principles of the invention may be applied to achieve the advantages described herein and to achieve other advantages or to satisfy other objectives, as well.

CLAIMS

What is claimed is:

1. A mounting hat for a brake rotor comprising:

a lower section coupled to an upper section,

a plurality of aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top and a bottom coupled to the upper section; and

a plurality of vents formed between adjacent aerodynamically shaped standoff vanes, wherein the vents are circumferentially distributed on the upper section, and air flow is induced to flow through the plurality of vents.

2. The mounting hat of claim 1, wherein the leading edge and the trailing edge of the plurality of aerodynamically shaped standoff vanes are curved.

3. The mounting hat of claim 1, wherein the leading edge and the trailing edge of the plurality of aerodynamically shaped standoff vanes are one of stepped up and ramped up from the upper section towards the top of the plurality of aerodynamically shaped standoff vanes.

4. The mounting hat of claim 1, wherein the leading edge and the trailing edge of the plurality of aerodynamically shaped standoff vanes are symmetrical.

5. The mounting hat of claim 1, wherein the leading edge and the trailing edge of the plurality of aerodynamically shaped standoff vanes are asymmetrical.

6. The mounting hat of claim 1, wherein the top of the plurality of aerodynamically shaped standoff vanes is bored to accept one of a drive pin, a bolt, and a lug.

7. The mounting hat of claim 1, wherein the upper section includes distributed openings.

8. The mounting hat of claim 7, wherein the plurality of aerodynamically shaped standoff vanes include an extension for coupling to the distributed openings.

9. A mounting hat for a brake rotor comprising:

a lower section coupled to an upper section,

a plurality of first aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top and a bottom coupled to the upper section;

a plurality of second aerodynamically shaped standoff vanes each having a leading edge, a trailing edge and a top coupled to the upper section; and

a plurality of vents formed between adjacent first aerodynamically shaped standoff vanes and second aerodynamically shaped standoff vanes,

wherein the vents are circumferentially distributed on the upper section, and air flow is induced to flow through the plurality of vents.

10. The mounting hat of claim 9, wherein the leading edge and the trailing edge of the plurality of first aerodynamically shaped standoff vanes are curved.

11. The mounting hat of claim 9, wherein the leading edge and the trailing edge of the plurality of second aerodynamically shaped standoff vanes are curved.

12. The mounting hat of claim 9, wherein the leading edge and the trailing edge of the plurality of first aerodynamically shaped standoff vanes are one of stepped up and ramped up from the upper section towards the top of the plurality of first aerodynamically shaped standoff vanes.

13. The mounting hat of claim 9, wherein the leading edge and the trailing edge of the plurality of second aerodynamically shaped standoff vanes are one of stepped up and ramped up from the upper section towards the top of the plurality of second aerodynamically shaped standoff vanes.

14. The mounting hat of claim 9, wherein the leading edge and the trailing edge of the plurality of first aerodynamically shaped standoff vanes are symmetrical.

15. The mounting hat of claim 9, wherein the leading edge and the trailing edge of the plurality of second aerodynamically shaped standoff vanes are symmetrical.

16. The mounting hat of claim 9, wherein the leading edge and the trailing edge of the plurality of first aerodynamically shaped standoff vanes are asymmetrical.

17. The mounting hat of claim 9, wherein the leading edge and the trailing edge of the plurality of second aerodynamically shaped standoff vanes are asymmetrical.

18. The mounting hat of claim 9, wherein the top of the plurality of first aerodynamically shaped standoff vanes is bored to accept one of a drive pin, a bolt, and a lug.

19. The mounting hat of claim 9, wherein the upper section includes distributed openings.

20. The mounting hat of claim 19, wherein the plurality of aerodynamically shaped standoff vanes include an extension for coupling to the distributed openings.

21. A brake rotor comprising:

a rotor,

a hub having a plurality of aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top, a bottom and a plurality of vents formed between adjacent aerodynamically shaped standoff vanes coupled to the rotor, wherein the vents are circumferentially distributed between the hub and the rotor, and air flow is induced to flow through the plurality of vents.

22. The brake rotor of claim 21, wherein the leading edge and the trailing edge of the plurality of aerodynamically shaped standoff vanes are curved.

23. The brake rotor of claim 21, wherein the leading edge and the trailing edge of the plurality of aerodynamically shaped standoff vanes are one of stepped up and ramped up towards the top of the plurality of aerodynamically shaped standoff vanes.

24. The brake rotor of claim 21, wherein the leading edge and the trailing edge of the plurality of aerodynamically shaped standoff vanes are symmetrical.

25. The brake rotor of claim 21, wherein the leading edge and the trailing edge of the plurality of aerodynamically shaped standoff vanes are asymmetrical.

26. The brake rotor of claim 21, wherein the top of the plurality of aerodynamically shaped standoff vanes is bored to accept one of a drive pin, a bolt, and a lug.

27. The mounting hat of claim 21, wherein the upper section includes distributed openings.

28. The mounting hat of claim 27, wherein the plurality of aerodynamically shaped standoff vanes include an extension for coupling to the distributed openings.

29. A brake rotor comprising:

a rotor;

a hub having a plurality of first aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top and a bottom coupled to the hub;

a plurality of second aerodynamically shaped standoff vanes each having a leading edge, a trailing edge and a top coupled to the hub; and

a plurality of vents formed between adjacent first aerodynamically shaped standoff vanes and second aerodynamically shaped standoff vanes,

wherein the vents are circumferentially distributed between the hub and the rotor, and air flow is induced to flow through the plurality of vents.

30. The brake rotor of claim 29, wherein the leading edge and the trailing edge of the plurality of first aerodynamically shaped standoff vanes are curved.

31. The brake rotor of claim 29, wherein the leading edge and the trailing edge of the plurality of second aerodynamically shaped standoff vanes are curved.

32. The brake rotor of claim 29, wherein the leading edge and the trailing edge of the plurality of first aerodynamically shaped standoff vanes are one of stepped up and ramped up towards the top of the plurality of first aerodynamically shaped standoff

vanes.

33. The brake rotor of claim 29, wherein the leading edge and the trailing edge of the plurality of second aerodynamically shaped standoff vanes are one of stepped up and ramped up towards the top of the plurality of second aerodynamically shaped standoff vanes.

34. The brake rotor of claim 29, wherein the leading edge and the trailing edge of the plurality of first aerodynamically shaped standoff vanes are symmetrical.

35. The brake rotor of claim 29, wherein the leading edge and the trailing edge of the plurality of second aerodynamically shaped standoff vanes are symmetrical.

36. The brake rotor of claim 29, wherein the leading edge and the trailing edge of the plurality of first aerodynamically shaped standoff vanes are asymmetrical.

37. The brake rotor of claim 29, wherein the leading edge and the trailing edge of the plurality of second aerodynamically shaped standoff vanes are asymmetrical.

38. The brake rotor of claim 29, wherein the top of the plurality of first aerodynamically shaped standoff vanes is bored to accept one of a drive pin, a bolt, and a lug.

39. The mounting hat of claim 29, wherein the upper section includes distributed openings.

40. The mounting hat of claim 39, wherein the plurality of aerodynamically shaped standoff vanes include an extension for coupling to the distributed openings.

ABSTRACT OF THE DISCLOSURE

The invention includes a mounting hat for a brake rotor having a lower section connected to an upper section. Also included is a plurality of aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top and a bottom connected to the upper section. Further, a plurality of vents are formed between adjacent aerodynamically shaped standoff vanes. The vents are circumferentially distributed on the upper section. Air flow is induced to flow through the plurality of vents. Alternatively included is a mounting hat for a brake rotor having a lower section connected to an upper section. Also included is a plurality of first aerodynamically shaped standoff vanes each having a leading edge, a trailing edge, a top and a bottom connected to the upper section. Further, a plurality of second aerodynamically shaped standoff vanes each having a leading edge, a trailing edge and a top connected to the upper section is included. Additionally, a plurality of vents are formed between adjacent first aerodynamically shaped standoff vanes and second aerodynamically shaped standoff vanes. The vents are circumferentially distributed on the upper section. Air flow is induced to flow through the plurality of vents.

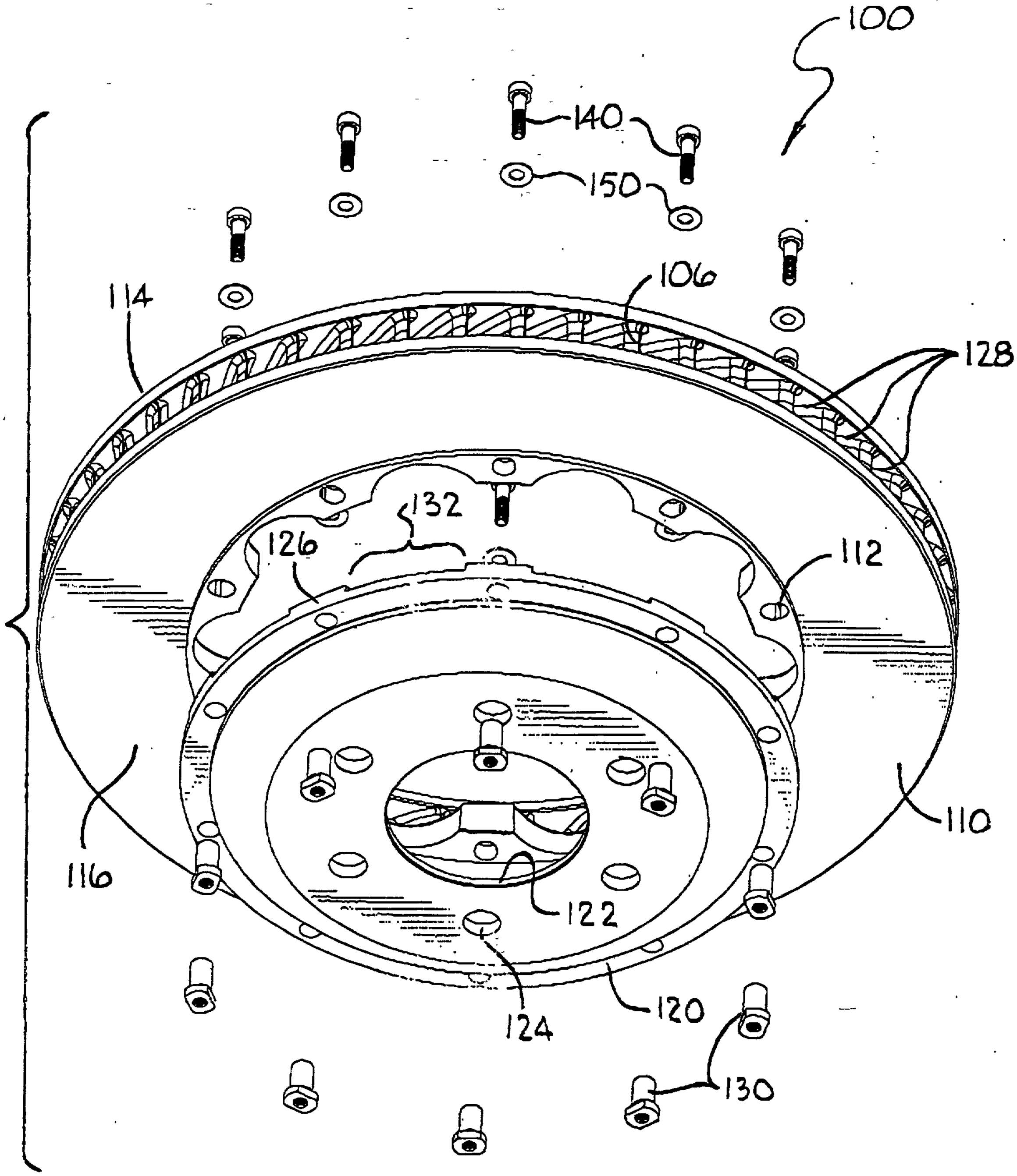
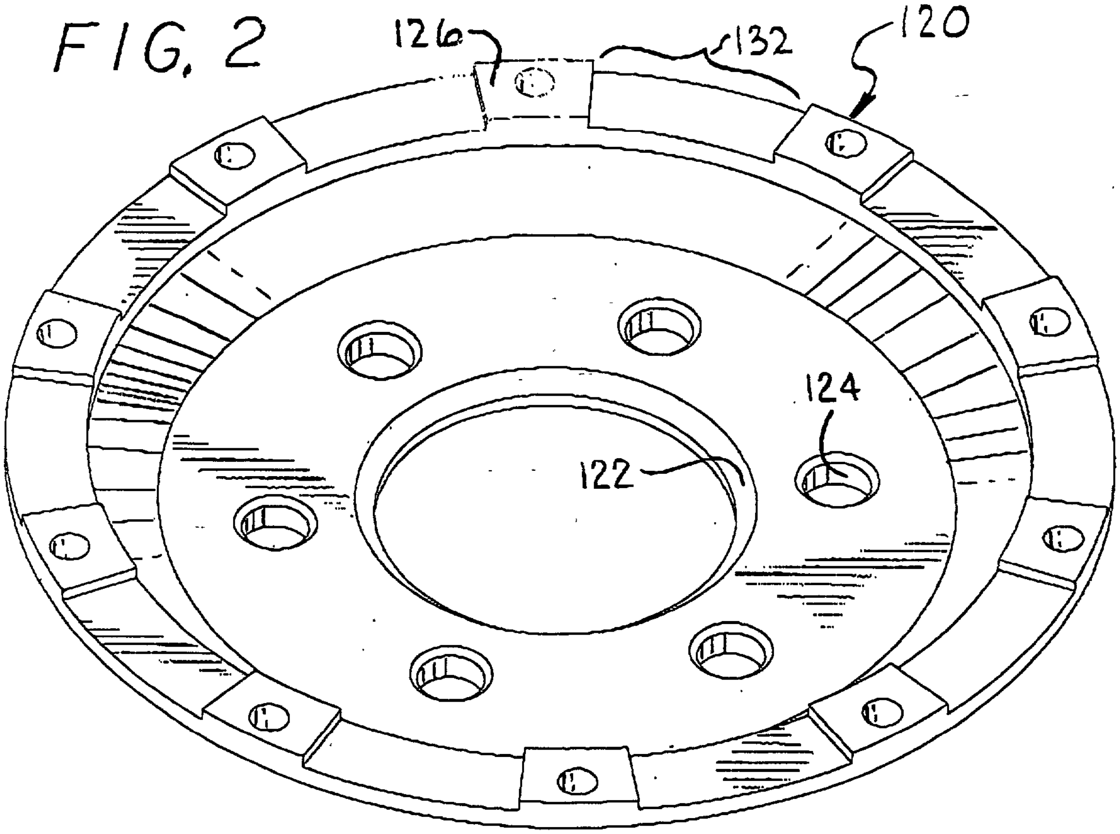


FIG. 1
PRIOR ART

FIG. 2



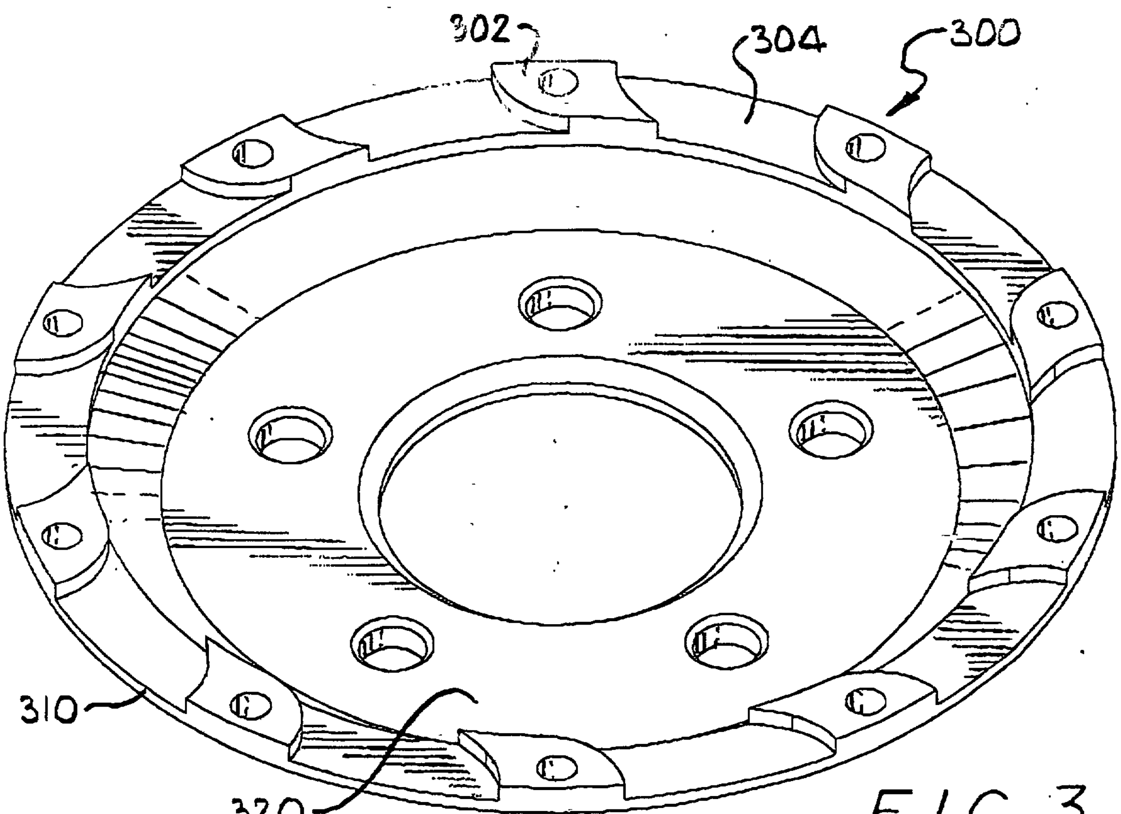


FIG. 3

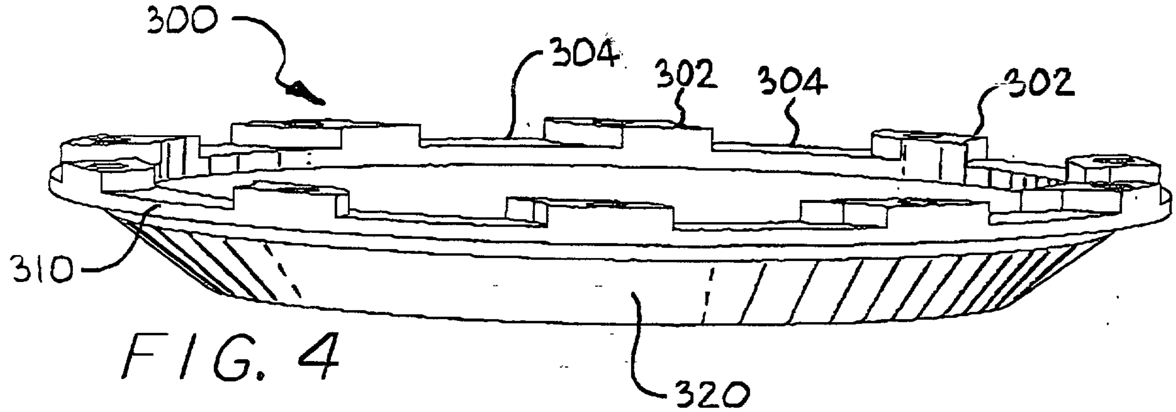


FIG. 4

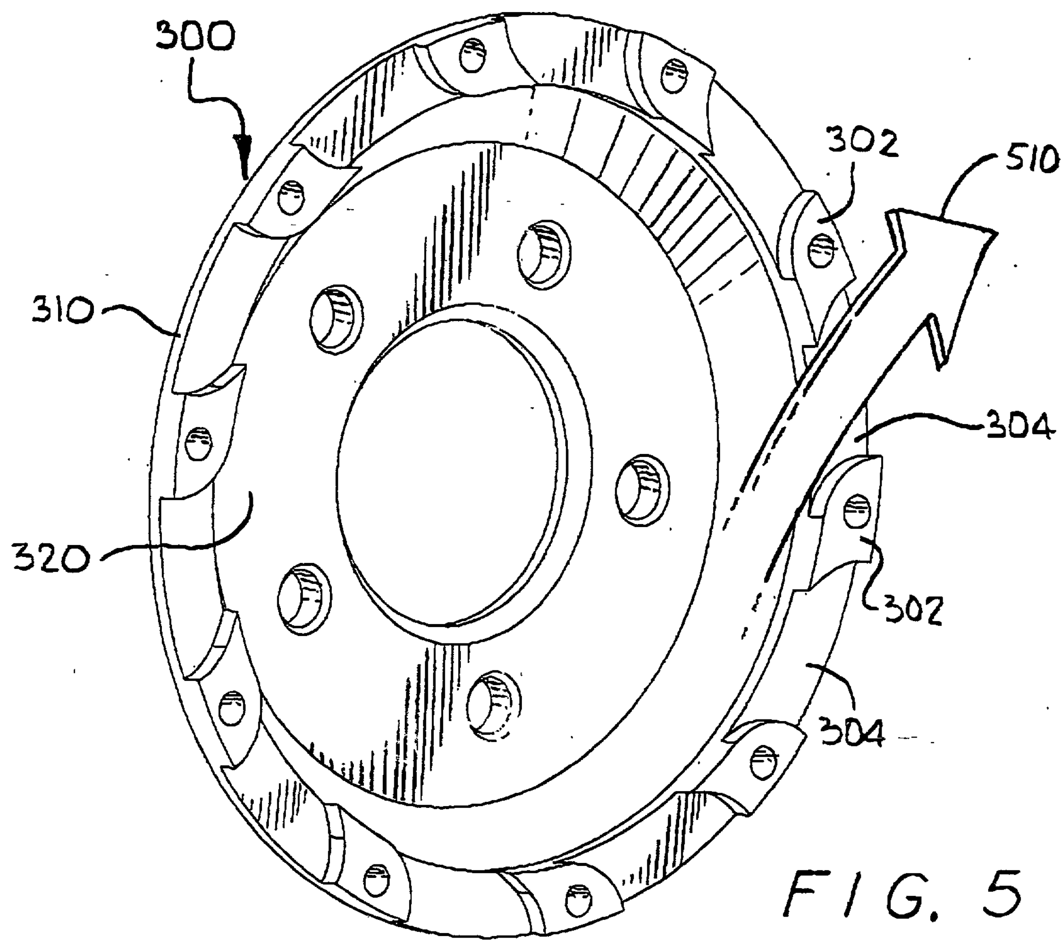


FIG. 5

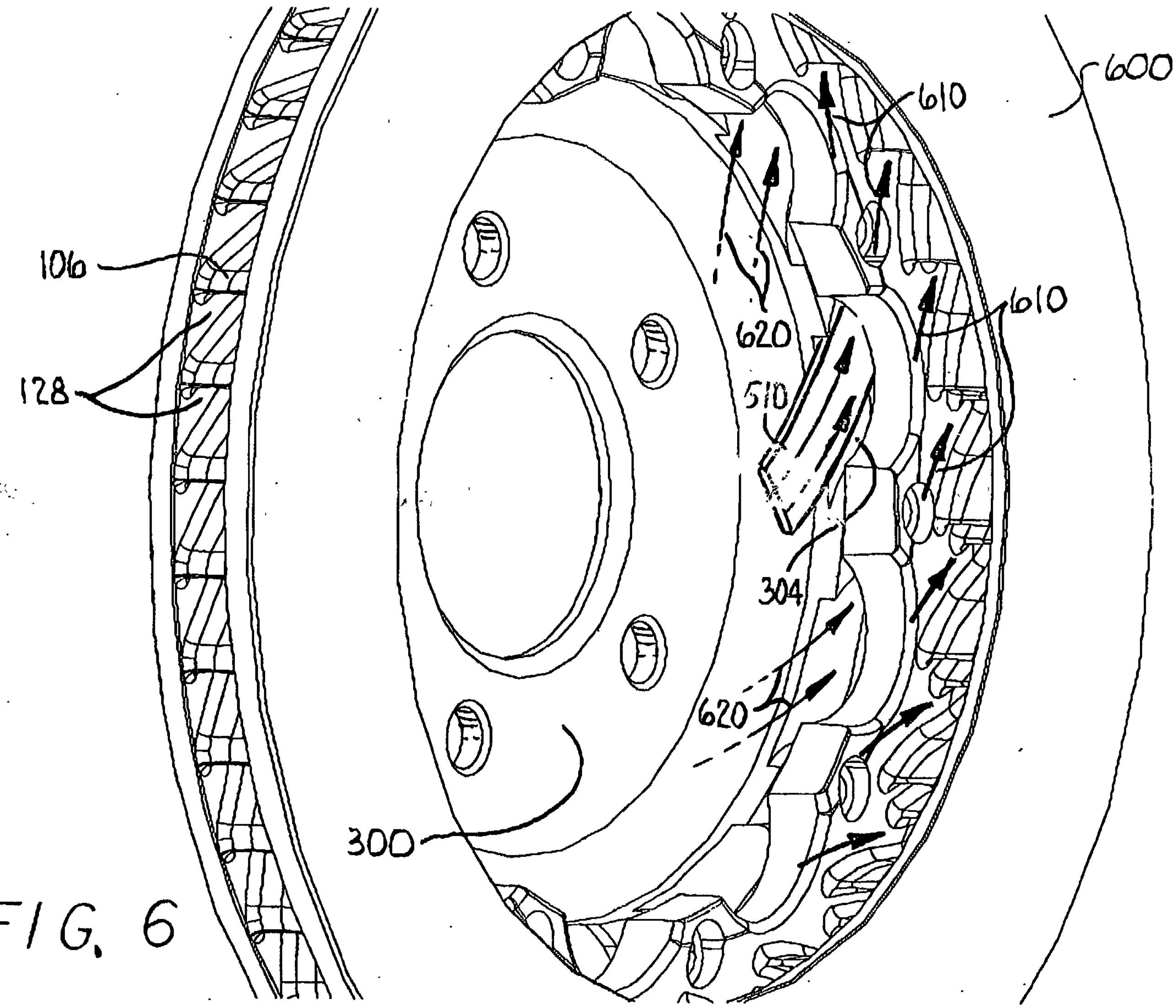


FIG. 6

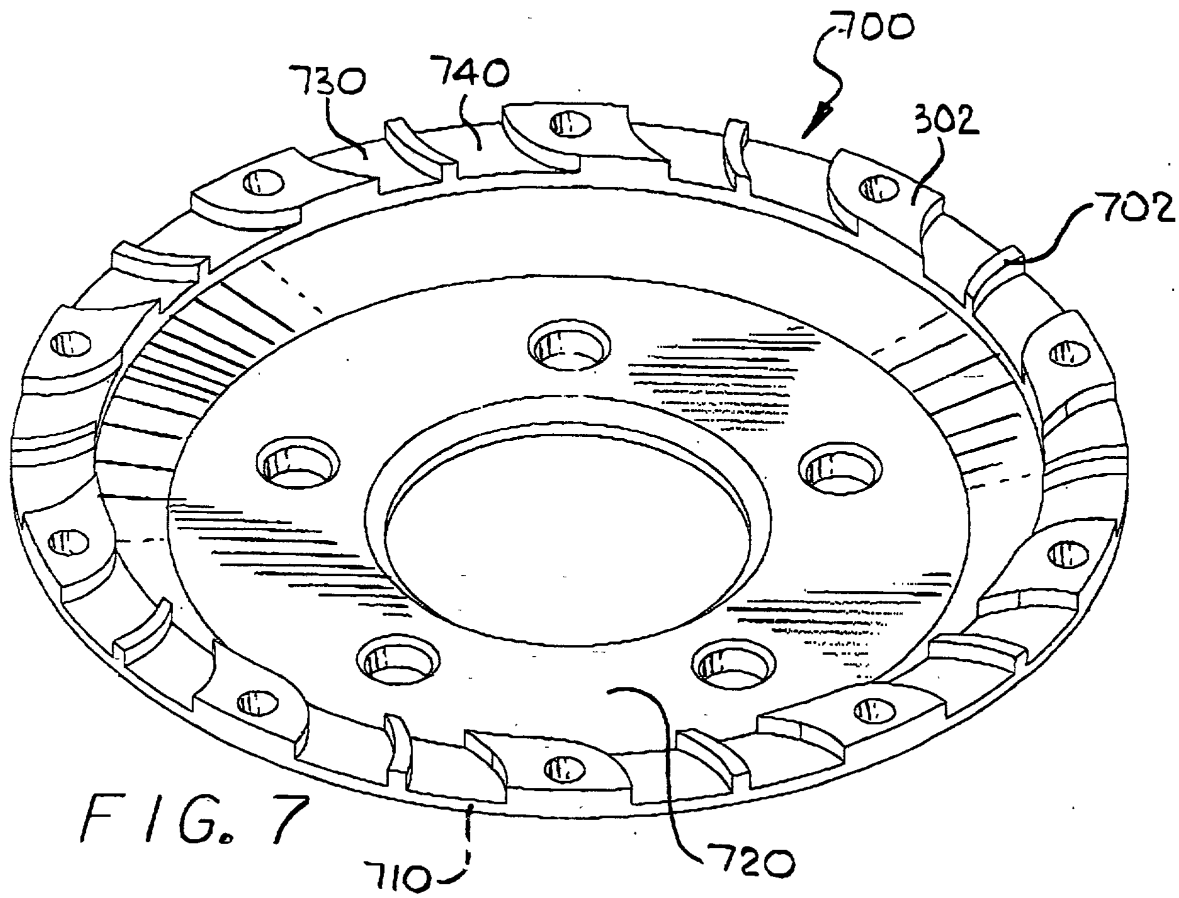


FIG. 7

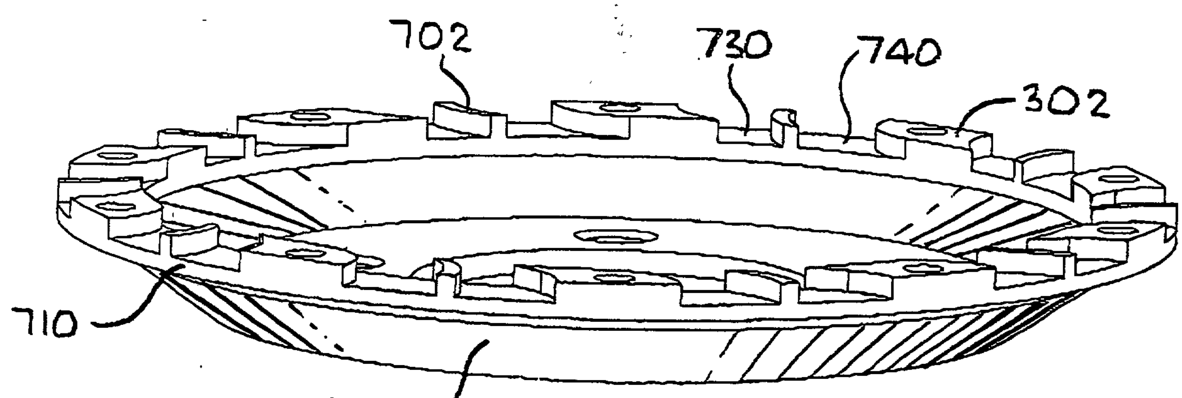


FIG. 8

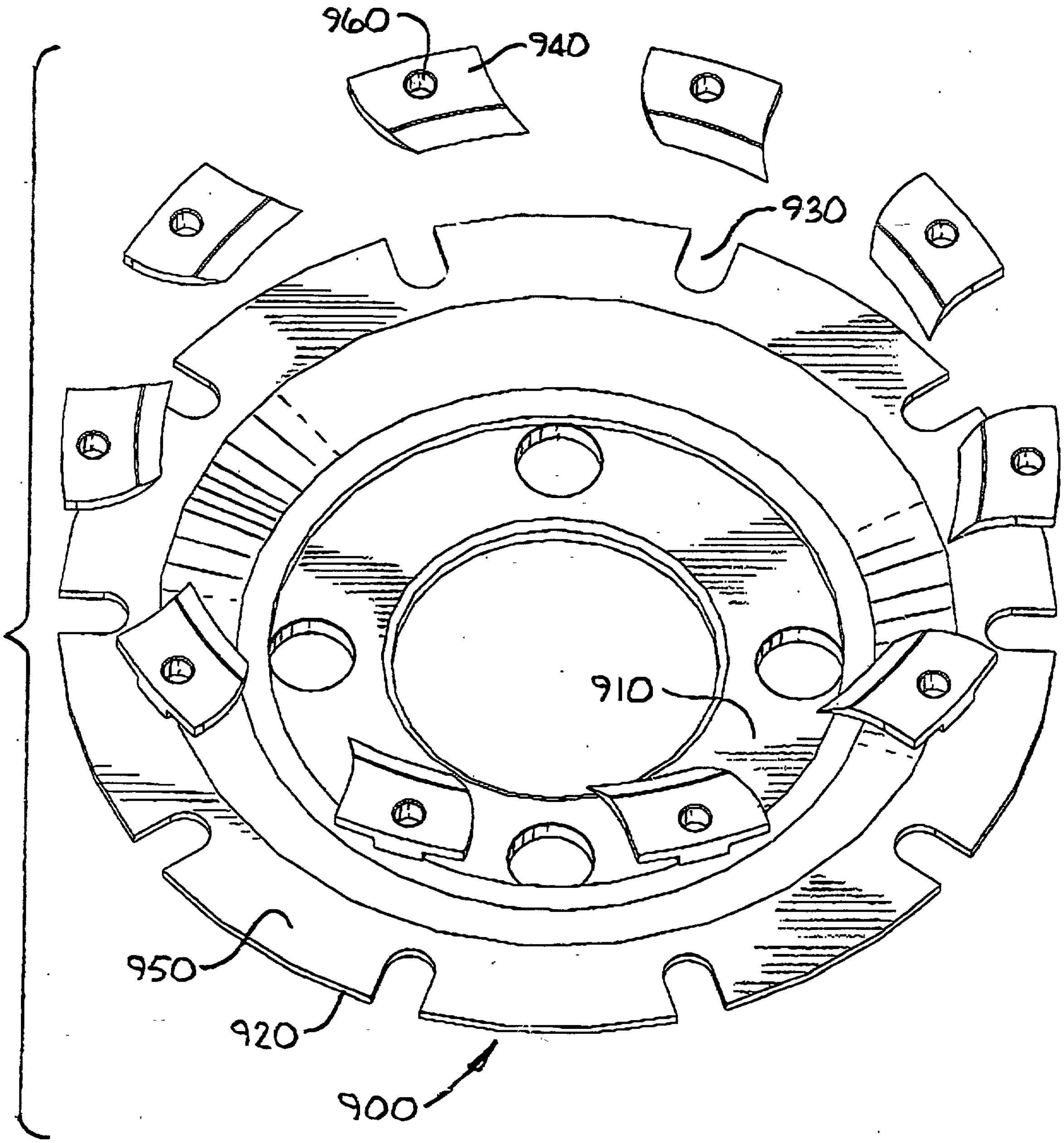


FIG. 9

FIG. 10

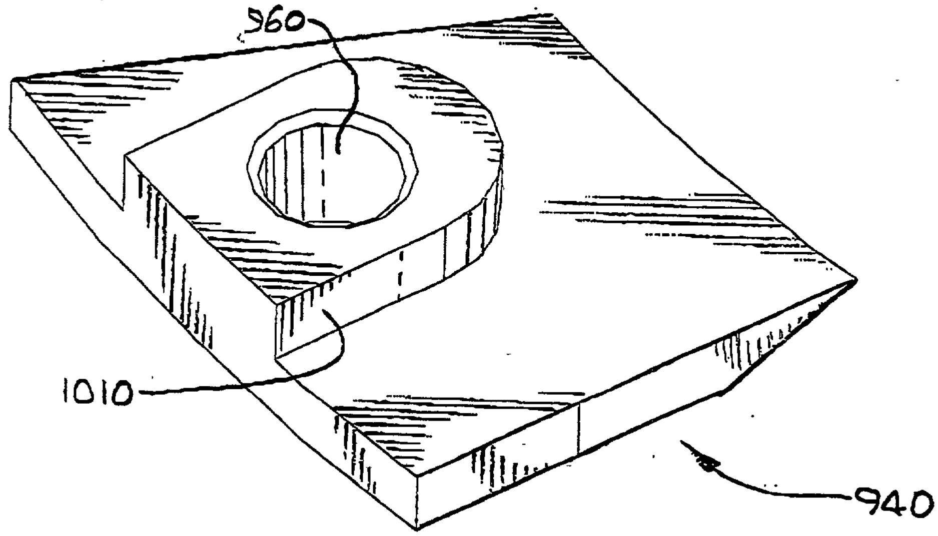
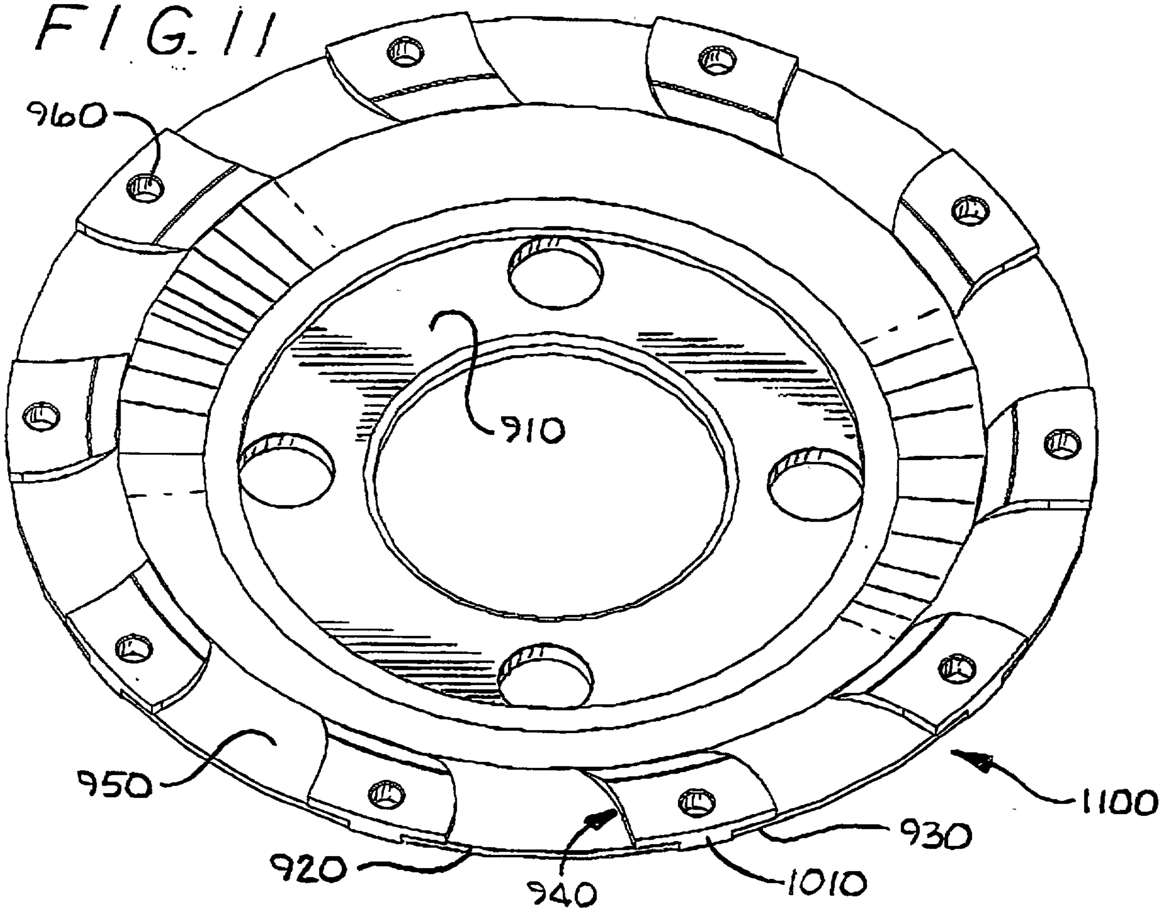
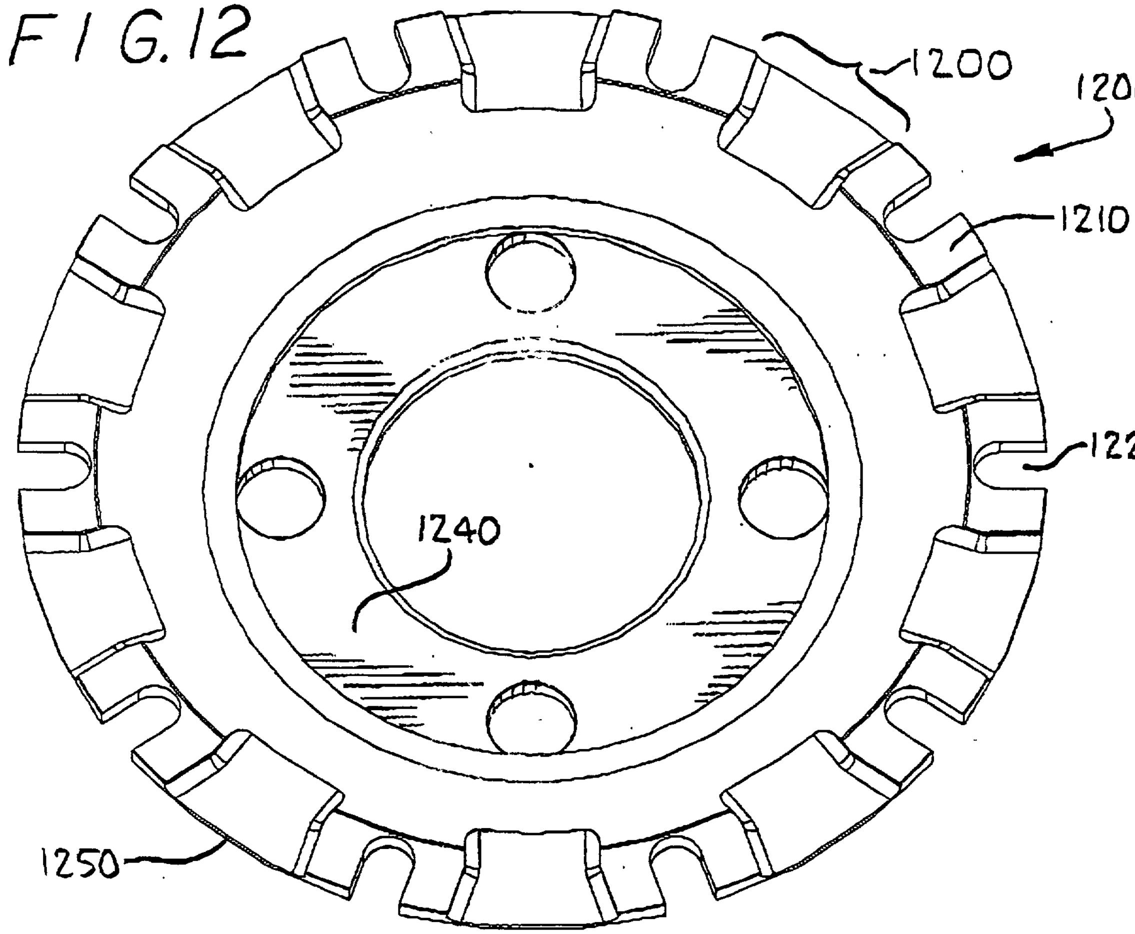
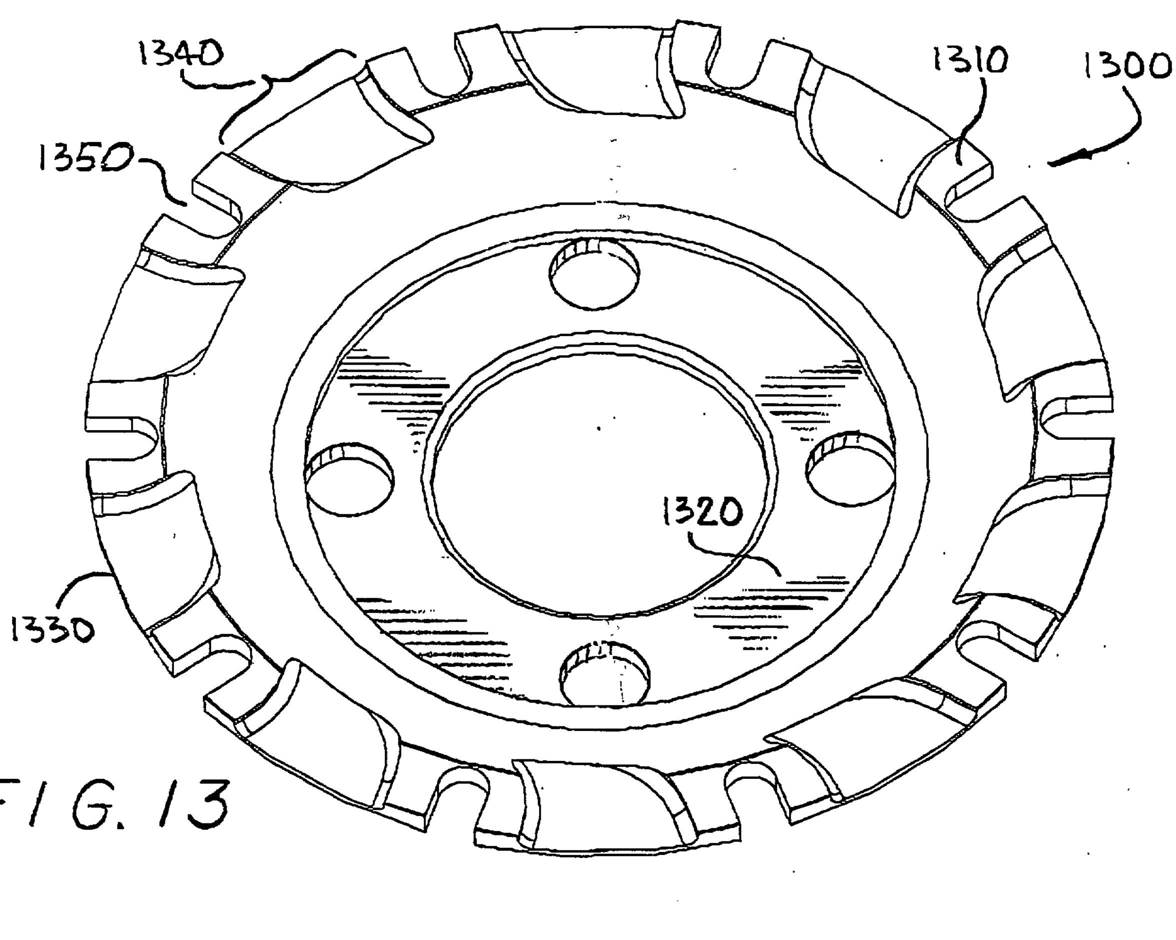


FIG. 11



F I G. 12





F I G. 13

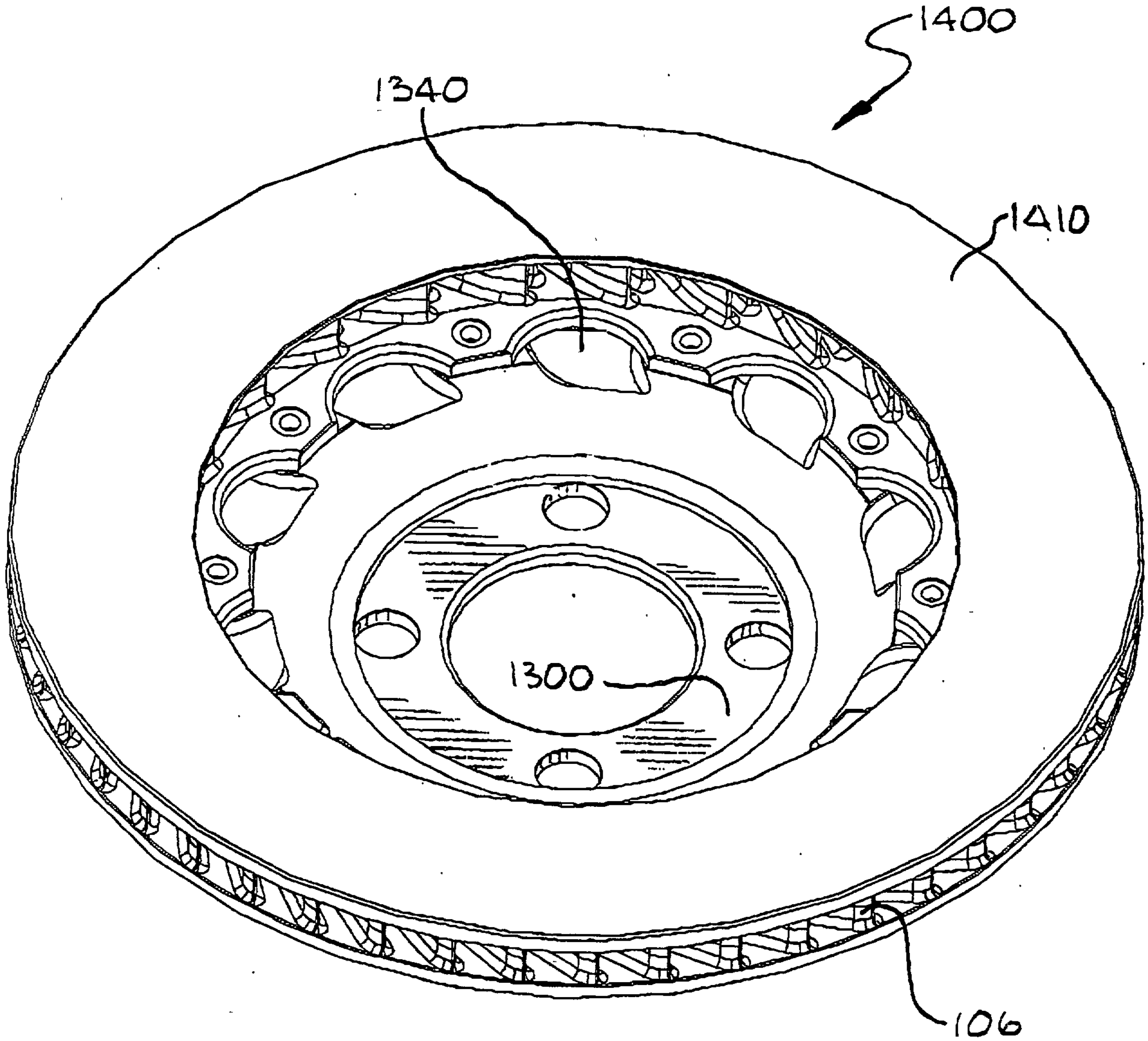


FIG. 14

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or any original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

AERODYNAMIC STANDOFFS TO AIR COOL DISC TYPE AUTO BRAKE ROTORS

the specification of which
[X] is attached hereto.
[ ] was filed on ______________ as
United States Application Number ______________
or PCT International Application Number ______________
and was amended on ______________ .
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):

APPLICATION NUMBER	COUNTRY (OR INDICATE IF PCT)	DATE OF FILING (day, **month**, year)	PRIORITY CLAIMED
			☐ No ☐ Yes
			☐ No ☐ Yes
			☐ No ☐ Yes

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION NUMBER	FILING DATE	STATUS (ISSUED, PENDING, ABANDONED)

I hereby appoint BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, a firm including: William E. Alford, Reg. No. 37,764; Farzad E. Amini, Reg. No. 42,261; William Thomas Babbitt, Reg. No. 39,591; Carol F. Barry, Reg. No. 41,600; Jordan Michael Becker, Reg. No. 39,602; Lisa N. Benado, Reg. No. 39,995; Bradley J. Bereznak, Reg. No. 33,474; Michael A. Bernadicou, Reg. No. 35,934; Roger W. Blakely, Jr., Reg. No. 25,831; R. Alan Burnett, Reg. No. 46,149; Gregory D. Caldwell, Reg. No. 39,926; Andrew C. Chen, Reg. No. 43,544; Thomas M. Coester, Reg. No. 39,637; Donna Jo Coningsby, Reg. No. 41,684; Dennis M. deGuzman, Reg. No. 41,702; Stephen M. De Klerk, Reg. No. P46,503; Michael Anthony DeSanctis, Reg. No. 39,957; Daniel M. De Vos, Reg. No. 37,813; Sanjeet Dutta, Reg. No. P46,145; Matthew C. Fagan, Reg. No. 37,542; Tarek N. Fahmi, Reg. No. 41,402; George Fountain, Reg. No 36,374; Paramita Ghosh, Reg. No. 42,806; James Y. Go, Reg. No. 40,621; James A. Henry, Reg. No. 41,064; Willmore F. Holbrow III, Reg. No. P41,845; Sheryl Sue Holloway, Reg. No. 37,850; George W Hoover II, Reg. No. 32,992; Eric S. Hyman, Reg. No. 30,139; William W. Kidd, Reg. No. 31,772; Sang Hui Kim, Reg. No. 40,450; Walter T. Kim, Reg. No. 42,731; Eric T. King, Reg. No. 44,188; Erica W. Kuo, Reg. No. 42,775; George Brian Leavell, Reg. No. 45,436; Gordon R. Lindeen III, Reg. No. 33,192; Jan Carol Little, Reg. No. 41,181; Kurt P. Leyendecker, Reg. No. 42,799; Joseph Lutz, Reg. No. 43,765; Michael J. Mallie, Reg. No. 36,591; Andre L. Marais, under 37 C.F.R. § 10.9(b); Paul A. Mendonsa, Reg. No. 42,879; Clive D. Menezes, Reg. No. 45,493; Chun M. Ng, Reg. No. 36,878; Thien T. Nguyen, Reg. No. 43,835; Thinh V. Nguyen, Reg. No. 42,034; Dennis A. Nicholls, Reg. No. 42,036; Daniel E. Ovanezian, Reg. No. 41,236; Kenneth B. Paley, Reg. No. 38,989; Gregg A. Peacock, Reg. No. 45,001; Marina Portnova, Reg. No. P45,750; William F. Ryann, Reg. 44,313; James H. Salter, Reg. No. 35,668; William W. Schaal, Reg. No. 39,018; James C. Scheller, Reg. No. 31,195; Jeffrey Sam Smith, Reg. No. 39,377; Maria McCormack Sobrino, Reg. No. 31,639; Stanley W. Sokoloff, Reg. No. 25,128; Judith A. Szepesi, Reg. No. 39,393; Vincent P. Tassinari, Reg. No. 42,179; Edwin H. Taylor, Reg. No. 25,129; John F. Travis, Reg. No. 43,203; Joseph A. Twarowski, Reg. No. 42,191; Thomas A. Van Zandt, Reg. No. 43,219; Lester J. Vincent, Reg. No. 31,460; Glenn E. Von Tersch, Reg. No. 41,364; John Patrick Ward, Reg. No. 40,216; Mark L. Watson, Reg. No. P46,322; Thomas C. Webster, Reg. No. P46,154; and Norman Zafman, Reg. No. 26,250; my patent attorneys, and Firasat Ali, Reg. No. 45,715; and Justin M. Dillon, Reg. No. 42,486; my patent agents, with offices located at 12400 Wilshire Boulevard, 7th Floor, Los Angeles, California 90025, telephone (310) 207-3800, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole/First Inventor (given name, family name) **Stephen John Ruiz**

Inventor's Signature [signature] Date 11-15-00

Residence REDONDO BEACH, CA (City, State) Citizenship USA (Country)

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